THE SAFESHORE SYSTEM FOR THE DETECTION OF THREAT AGENTS FOR MARITIME BORDER SURVEILLANCE

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SafeShore

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The Problem – Illegal use of RPAS / small vessels

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Legitimate use of drones

- Many legitimate use cases:
  - Mapping
  - Police
  - SAR
  - Movies & Films
  - Hobby
  - Delivery
  - Inspection
  - …

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The Problem – How to regulate?

- Over the course of centuries, we created a road traffic network, with a set of rules and a police force to control / enforce these rules
- Now, we have to do the same with low-altitude aerial traffic

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The Problem – How to regulate?

- Over the course of centuries, we created a road traffic network, with a set of rules and a police force to control / enforce these rules
- Now, we have to do the same with low-altitude aerial traffic

But how can we enforce these rules if we do not know where the different agents (drones) are?

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The Problem – Illegal use of drones

- Smuggling: borders, restricted areas, prisons, illegal items (drugs, CBRN goods, weapons, …), tax evasion (cigarettes, …)

- Examples:
  - Drone found crashed in Tijuana while carrying high-risk drugs (Mexico, 20 January 2015).
  - Drone was used to deliver a container with radioactive material on the roof of the Japan's Prime Minster's residence (9 April 2015).

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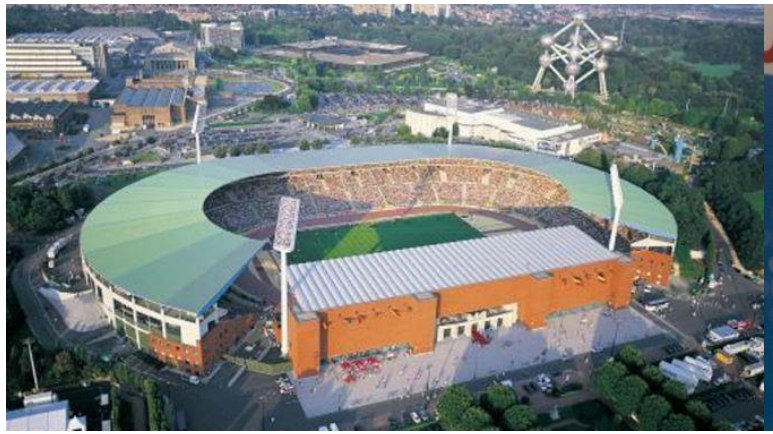
The Problem – Illegal use of drones

- Illegal surveillance:
  - 56 cases of drones illegal surveillance of nuclear power plants since October 2014
  - Violation of privacy of celebrities, neighbours, …

The Problem – Illegal use of drones

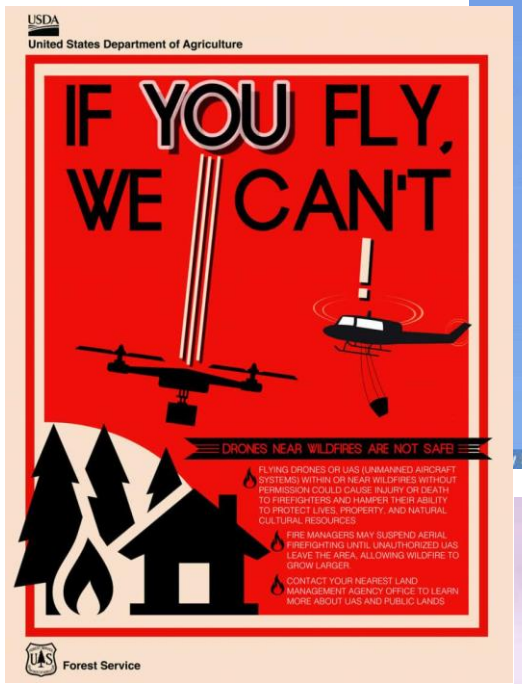
- Terrorism:
  - IS using drones domestically to spy on ‘enemy’ troops / force protection
  - Hamas using drones against Israel

- Activism
  - Drones were used during the 2013 German election campaign.
  - Drone with Palestinian flag apprehended in Brussels before Belgium-Israel football game.



The Problem – Illegal use of drones

- Drones interfering with manned aviation:
  - More and more incidents near airports
    - ➔ Huge economical impact
  - Drones interfering with SAR / forest fire operations
    - ➔ Huge societal impact



- Drones falling / injuring people
  - Small drones generally have no redundant fail-safe systems.

EU-H2020 Call on Maritime Border Security

Topic 2: Affordable and easily deployable technologies for EU coastal border surveillance with reduced impact on the environment

Specific challenge

- The use of **low cost and "green" technologies** is expected to become mandatory for future border control systems in environmentally sensitive areas. Passive systems fit this application, due to **electromagnetic invisibility**, **lower detectability** and **cost** and the **possibility of use practically anywhere**.

Scope

- further development of **devices and sensors for maritime targets and environment** (e.g. fit for mobile platforms) easily deployable on field and with **limited impact on spectrum environment**.
- development of specific, **early identification, tracking and fusion** algorithms
- operation in **network configurations** together with other systems for improved performances

Safeshore Project started on 01 May 2016

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Consortium

Academia Partners	Country	Scope
Royal Military Academy of Belgium	**Belgium**	**Consortium coordinator, passive radio detection**
Queen Mary University	UK	Algorithms development
University of Salento	Italy	Requirements analysis

Industry Partners	Country	Scope
Dr. Frucht Systems Ltd.	Israel	Laser detection systems and algorithms
UTI Grup	Romania	Video analytics, data fusion, GIS & C2
TG Drives	Czech Republic	Laser detection systems platform
Optix	Bulgaria	Visible & thermal camera systems

Research Partners	Country	Scope
Institute of Optoelectronics	Romania	Visible & thermal camera systems

End User Partners	Country	Scope
The Protection and Guard Service	Romania	Field trial of the system (Black Sea)
Ministry of Public Security	Israel	Field trial of the system (Mediteranean Sea)
Police Region West Coast	**Belgium**	**Field trial of the system (North Sea)**

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SafeShore proposed solution

- **Mission**
  - Detection of **low altitude drones and their remote control equipment** involved in unauthorized surveillance and offensive actions (delivery of explosive charges or small projectile attacks), launched from boats, ships or land, in border area harbours, in coast radar locations, at river border crossings and on-board oil platforms and large ships.
  - Detection of **small vessels coming to shore**
  - Detection of **humans emerging from the sea**
- **The SafeShore system can be used as:**
  - **stationary detection point**
    - in harbour areas, at river border crossing, to detect remote delivery of explosives or chemical weapons, and border trafficking of drugs
    - for coast radars, to detect remote delivery of explosive charges
  - **stationary chain-of-detectors** along high-risk border areas, to provide long term protection in areas with persistent problems
  - **mobile deployable system** in areas where intelligence predicts higher volume of illegal or threatening activities.

Technology

SafeShore will develop a system integrating multiple commercially available detection technologies to ensure detection of low-altitude flying drones and small boats

- **Laser ranging (LIDAR) detection** of small drones at low altitude, where radars cannot ensure detection due to altitude radar limitation and small radar cross section of the target
- **Passive acoustic detection**, to offer a complementary detection technology that is not affected by the same adverse effects as the laser scanner, and to provide means for acoustic target classification
- **Visible and thermal CCTV target classification**, to provide means of verifying the detection and classifying the target based on its aspect; classification result will be combined with the acoustic target classification result
- **Passive radio communication detection and localization** of remote control stations on sea or land, by passive spectrum monitoring and triangulation

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Detection Modality 1 - Vision

- Camera monitors the sky and tries to detect drones

- Limited Range = limited interception time
- Difficult to deploy in cluttered environment (e.g. urban)
- Difficult to filter out birds / sun reflections
- Does not work at night

Can be used as a supporting sensing modality, but not as a main sensor

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Detection Modality 2 - Infrared

- Infrared camera monitors the sky and tries to detect drones

- Limited Range = limited interception time
- Difficult to deploy in cluttered environment (e.g. urban)
- Difficult to filter out birds / sun reflections

- Better detection capability than visual
- Works day and night
- Can be used as supporting sensing modality, but not as main sensor

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Detection Modality 3 - Acoustic

- Two possibilities:
  - Try to detect propeller noise in audible spectrum
  - Try to detect motor PWM frequency in ultrasound spectrum

- Limited Range = limited interception time
- Difficult to deploy in noisy environment (e.g. urban)

Better detection capability than optical

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Detection Modality 4 - Lidar

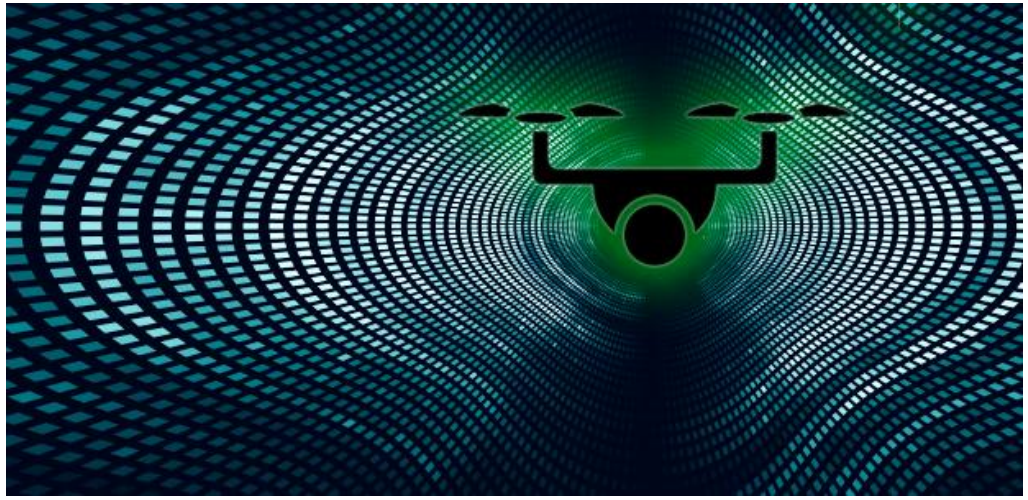
- Uses laser to search the sky for drones

- Experimental
- Range limited by laser power

- Very Precise detection
- Very Precise localisation
- Multiple targets
- All-weather

Detection Modality 5 – Radio Communication

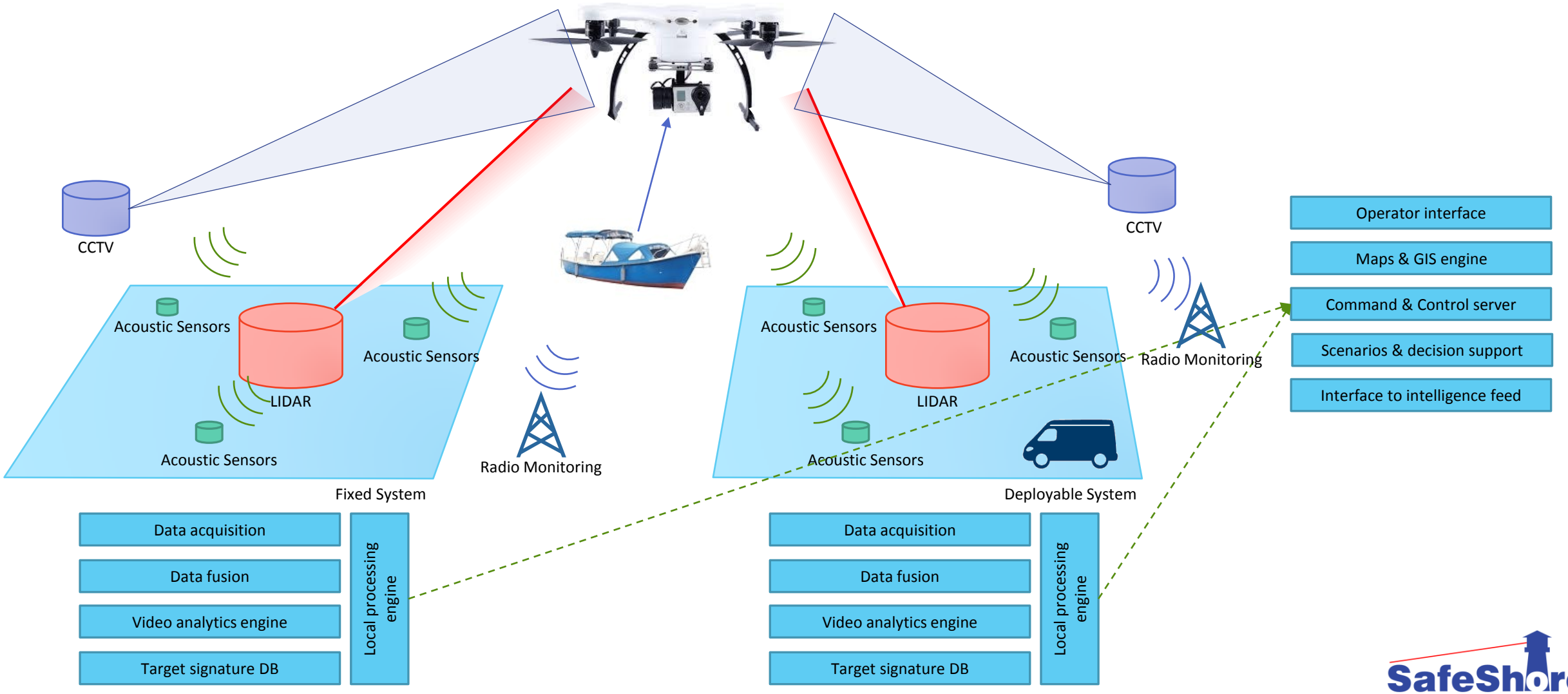
- Scan radio frequency spectrum to detect remote control commands



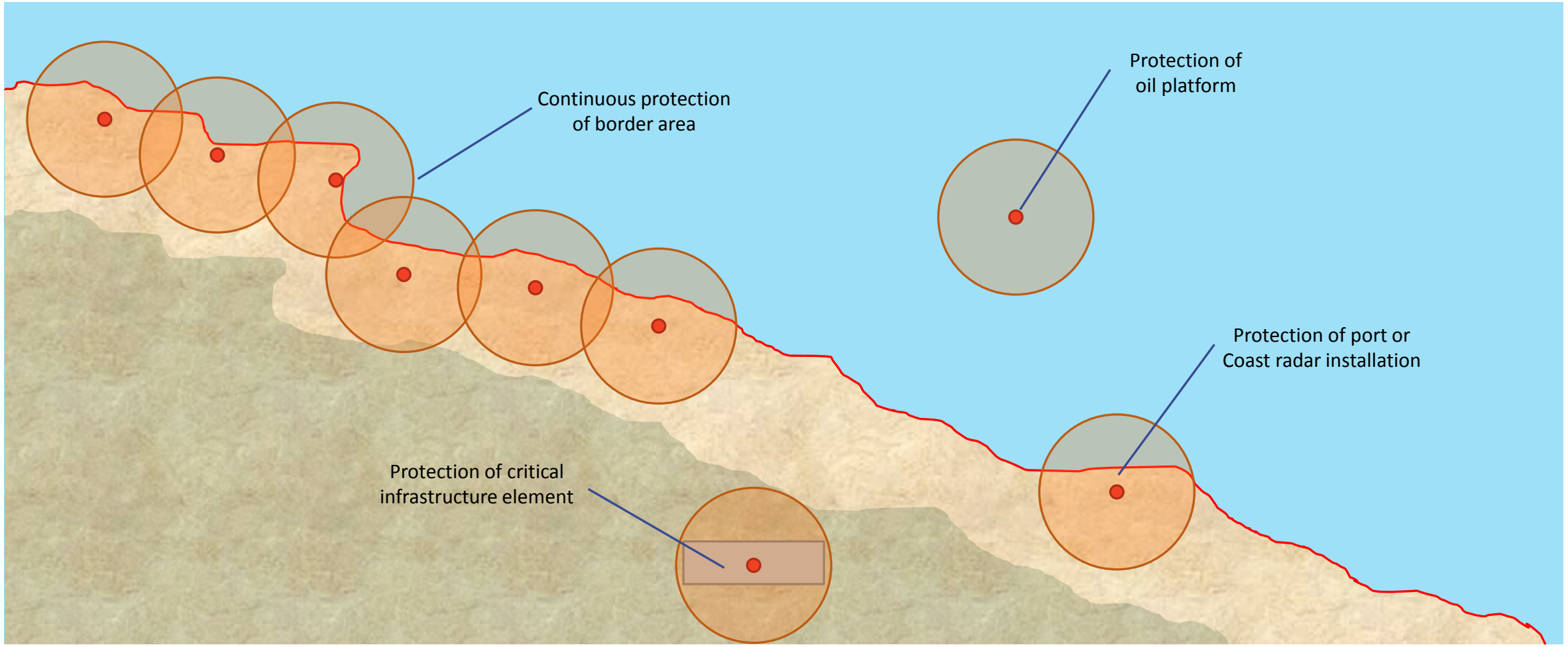
- Depends on remote operation, fails for autonomous operations.
- Localisation often very imprecise

- Range
- Multiple targets
- All-weather

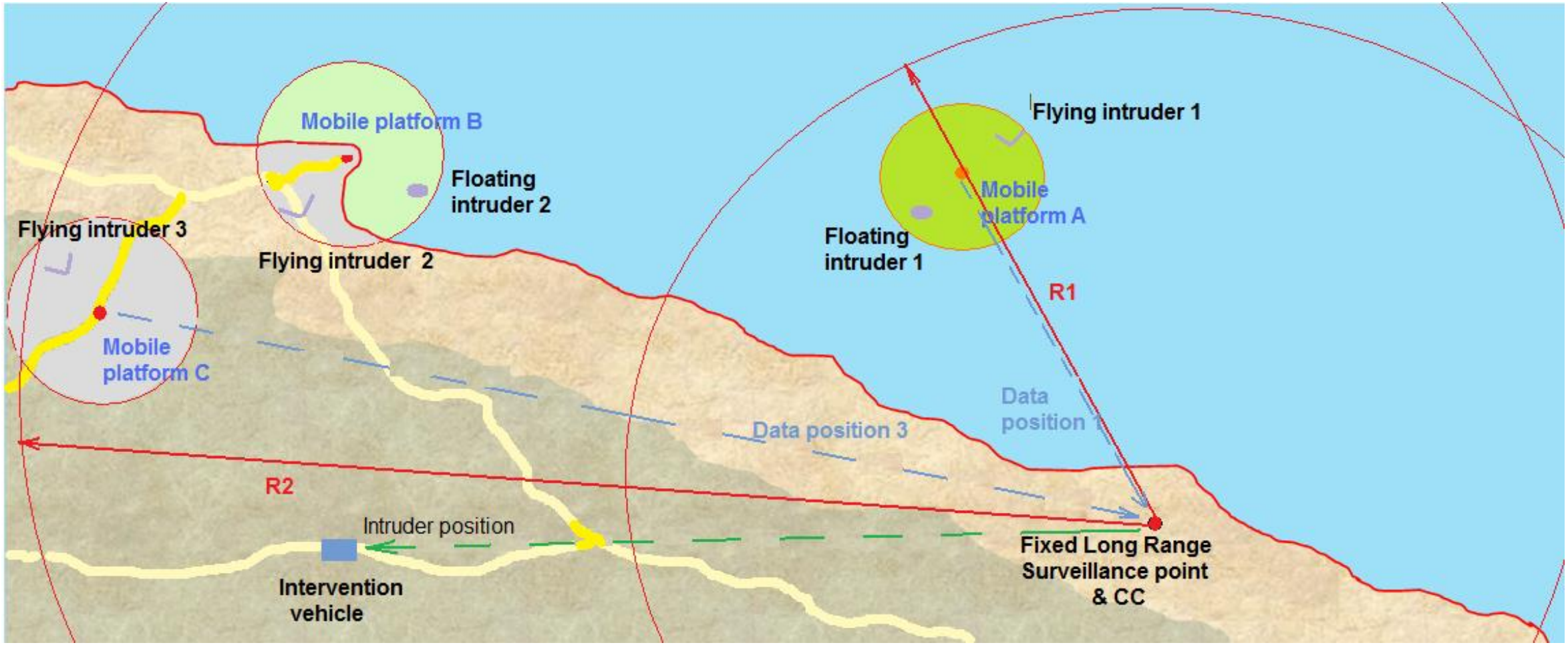
System Diagram



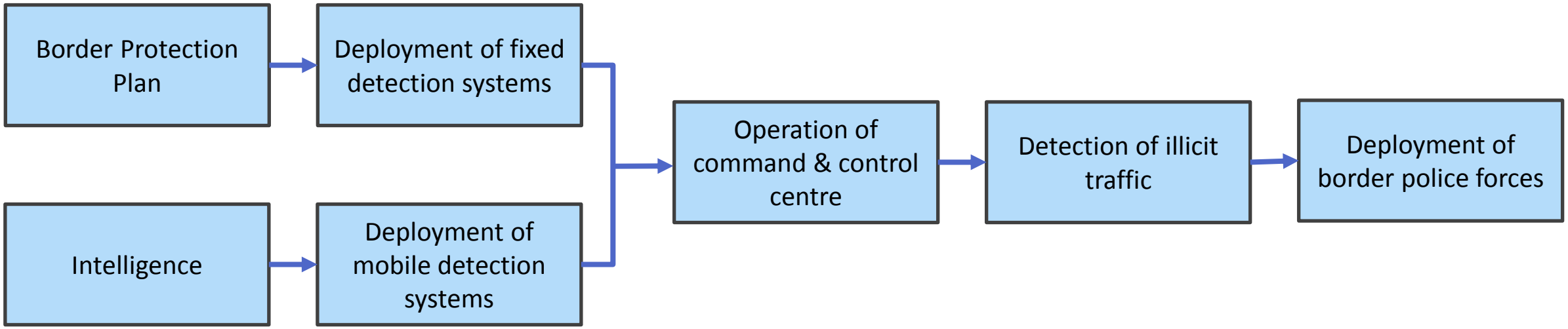
Sample Deployment of Detection Systems



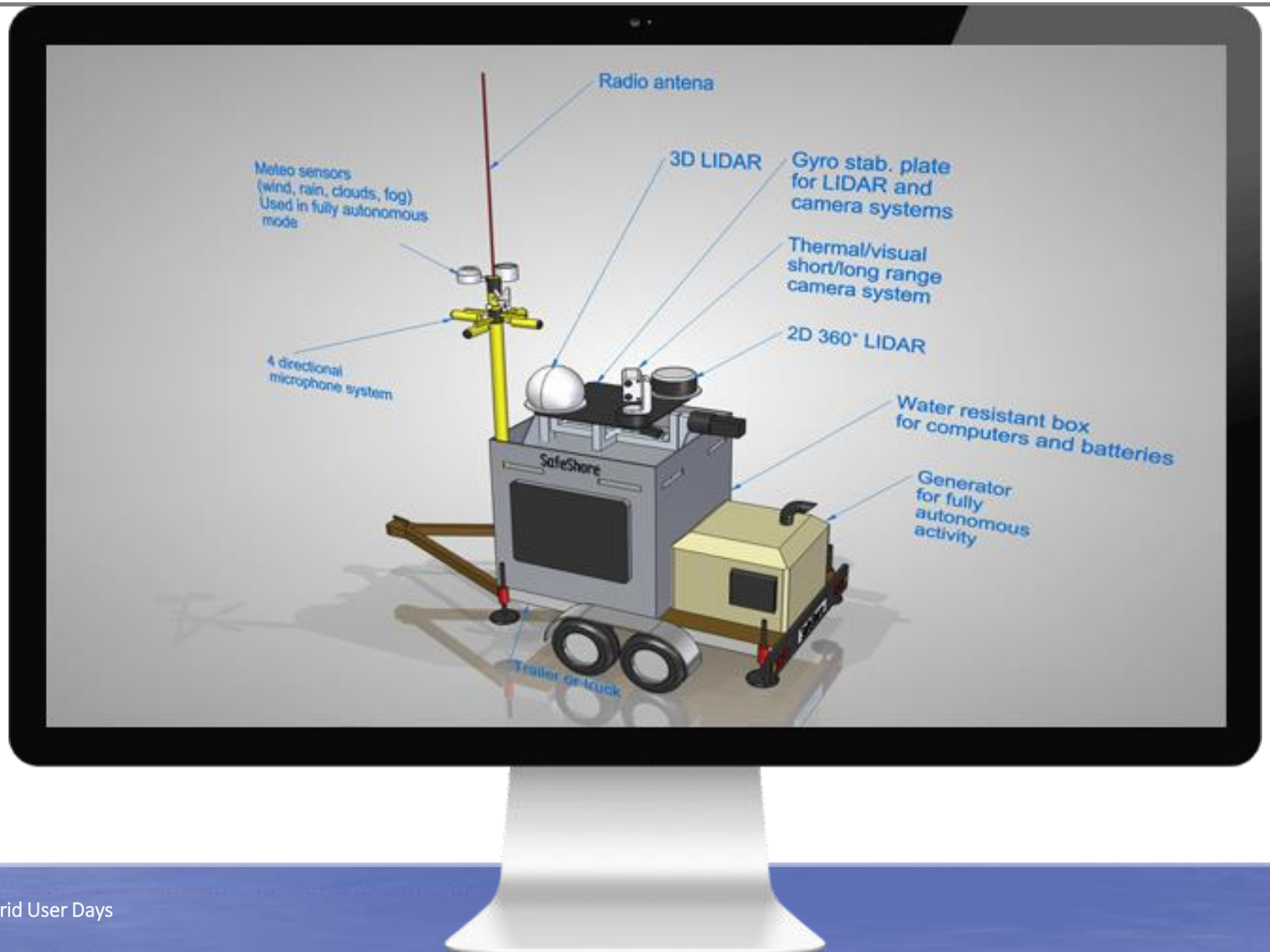
Detection, Assessment, Tracking & Response



Operation


Border Protection Plan
Deployment of fixed detection systems
Intelligence
Deployment of mobile detection systems
Operation of command & control centre
Detection of illicit traffic
Deployment of border police forces

Operational Deployment



Adaptability to Other Uses

Protection of Critical Infrastructure

- Rogue drones can be used to deliver explosive charges or CBRN agents as part of a terrorist attack against Critical Infrastructure sites
- Early detection of such drones can be used in combination with various counter- drone measures (entanglement nets, ballistic)

Protection of government officials

- Drones are a risk factor in case of public events where government officials or other VIPs can be the target of attacks using drones as means of delivery
- Early detection of such drones can be used in combination with various counter- drone measures (entanglement nets, ballistic) or evacuation measures

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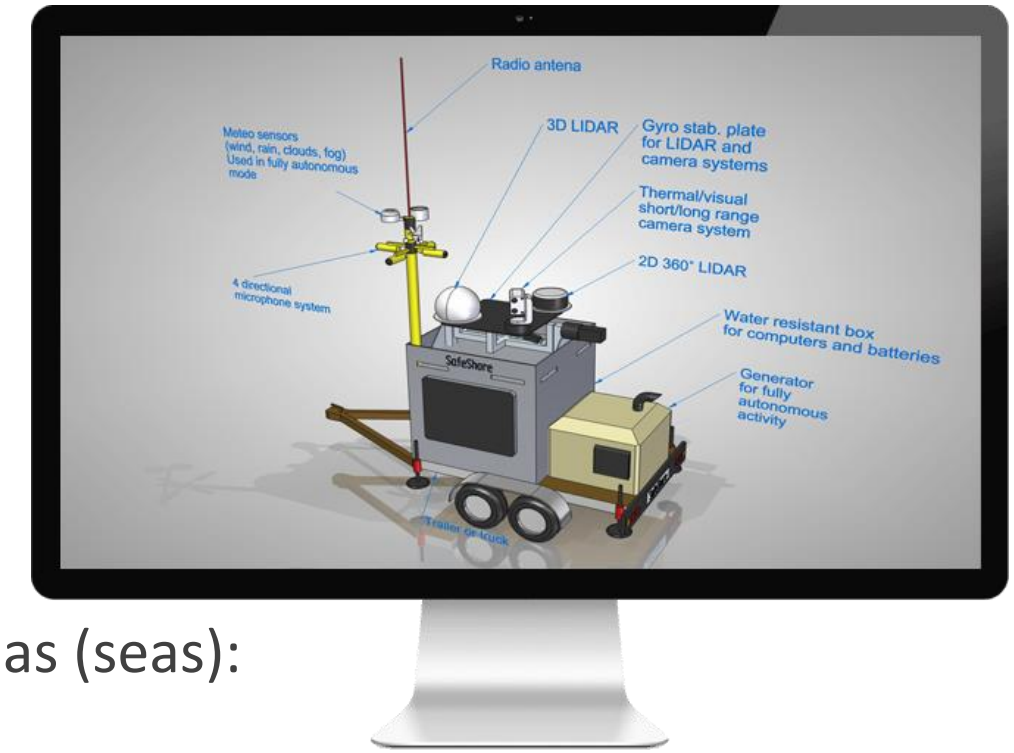
Way Ahead

September 2016 – Q1 2018:

- Technical development
- Integration of subsystems
- Integration into operational concept of end-users
- Handling of privacy and ethical concerns



May 2018 – September 2018:

Operational field trials in 3 different geographical areas (seas):

- **North Sea: Belgium – Lombardsijde: May 2018**
- Mediterranean: Israel - Netanya: July 2018
- Black Sea: Romania – Constanta: September 2018

Way Ahead – We need your input!

What can you do to help us?

- Define user requirements
- Define realistic validation scenarios

Why?

- Ensure that SafeShore developments are in line with your operational needs

How?

- Meet us this afternoon from 13:00 and 16:00 in the room “Beckham” (next to Ronaldo) for a workshop to discuss these issues

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Conclusions

- SafeShore will develop a system for the detection of low-altitude flying drones and small boats
- SafeShore will validate this technology in 3 different locations / seas, **including Belgium**
- A qualitative and quantitative validation methodology will be followed

- This is still in an early stage: **We are very open to your expert opinion on threats, optimal validation means, …**

QUESTIONS?

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